

REMARKS

By way of the instant amendment, claims 7-11 have been cancelled. Claims 12 and 13 have been added. Thus, claims 1-6 and 12-13 remain for examination.

Drawings

By way of a separate letter attached hereto, applicant has proposed modifications to figures 6 and 7 as suggested by the examiner. With the examiner's approval, the formal drawings will be so modified.

Written Description

By way of the present amendment, the specification has been carefully reviewed and amended in order to correct minor errors noted therein. In particular, the error noted by the examiner in paragraph 2 of the outstanding office action has been corrected.

Claim Objections

The objection to claim 6 as stated in paragraph 3 of the outstanding office action has been corrected. In particular, claim 6 now recites that the end portion of at least one of the array substrate and the opposing substrate has a tapered configuration.

Rejections Under § 112

Applicant has carefully reviewed the claims and amended same in order to remove all of the rejections set forth in paragraphs 5-7 of the outstanding office action. Additionally, other changes have been made in order to clarify the claims, and it is submitted that applicant's claims are now in full compliance with the provisions of 35 U.S.C. § 112.

Prior Art Rejections

Claims 1-2 and 4-5 stand rejected under 35 U.S.C. § 103 as unpatentable over Kazias (5,919,606) in view of Hirakata (6,219,127). The examiner's rejections are respectfully traversed.

The examiner appears to be citing Kazias for teaching all recitations of applicant's claims 1 and 5 with the exception of the polishing of the substrates. For the polishing aspect of applicant's claims, the examiner turns to the Hirakata patent. However, it should be noted that Kazias does not disclose all limitations of applicant's

claims 1 and 5 with the exception of the polishing step. Indeed, Kazias does not disclose the seal surrounding the individual liquid-crystal injection areas nor does Kazias disclose the whole sealant for the outer peripheral seal. The examiner indicates that the seal for the individual liquid-crystal injection areas is identified by element 950 in Kazias fig. 9. However, element 950 is merely taught to be a bonding pad (see column 11, line 5) and is not disclosed as a sealant. Moreover, while the outer peripheral seal 920 of Kazias appears to have apertures therein (from the drawings but not discussed in the written description) there is no disclosure either in the drawings nor the written description that the apertures are sealed.

The above-enumerated limitations are also not found in the teaching of Hirakata and thus, the Patent and Trademark Office has not made out a *prima facie* case of obviousness under the provisions of 35 U.S.C. § 103.

With regard to applicant's claim 2, the examiner states that Kazias discloses the plurality of apertures at the outer peripheral seal. While the apertures are indeed shown in fig. 9, Kazias does not disclose the hole sealants for the apertures as pointed out above.

With regard to claim 4, while Kazias does disclose utilizing UV curing as being problematic in the prior art, Kazias does not disclose the utilization of two types of sealing material, namely, an outer peripheral sealant comprising epoxy resin and a hole sealant comprising UV-curing acrylic resin. Indeed, Kazias does not disclose any hole sealant whatsoever.

Claim 3 stands rejected under 35 U.S.C. § 103 as unpatentable over Kazias in view of Wenz (5,268,782). The examiner states that Kazias does not explicitly disclose polarizers, but that polarizers are well-known from the teaching of Wenz. However, claim 3 is dependent on claim 1 and thus includes all of the limitations of claim 1. As pointed out above, claim 1 recites numerous limitations which are not disclosed in Kazias nor are these limitations found in the teaching of Wenz. As such, the combination of Kazias and Wenz does not make out a *prima facie* case of obviousness under the provisions of 35 U.S.C. § 103.

Claim 6 stands rejected under 35 U.S.C. § 103 as unpatentable over Kazias in view of Ishihara (5,537,235). The examiner states that Kazias does not disclose the tapered configuration and points to Ishihara for such teaching. Claim 6,

however, is dependent upon claim 5, and as pointed out above, numerous limitations of claim 5 are not disclosed in Kazias. Ishihara likewise does not supply the ingredients missing from Kazias. As such, the combination of Kazias and Ishihara does not make out a *prima facie* case of obviousness as to claim 6.

Submitted herewith are new claims 12 and 13, which recite applicant's invention using somewhat alternative language and formatting. These claims likewise contain the limitation set forth above in which the plurality of LCD areas are surrounded by a seal having an aperture and that there is an outer peripheral seal formed of a first material having at least one pair of oppositely disposed apertures and further that there is an aperture sealant formed by a second material, softer than the first material, and positioned within the at least one pair of oppositely disposed apertures. Moreover, newly submitted independent claim 12 recites that an end portion of at least one of the arrayed substrate and opposing substrate is polished and tapered so as to be smaller than a non-end portion. The smaller tapered portion on the end is to be contrasted with the larger end portions in Ishihara which are tapered to a narrower central region.

In view of the amendments made hereto and the arguments set forth above, it is submitted that the Patent and Trademark Office has not established a *prima facie* case of obviousness under the provisions of 35 U.S.C. § 103 as to any of applicant's claims including newly-submitted claims 12 and 13. It is thus submitted that all of applicant's claims presently pending are patentable.

The application is now deemed to be in condition for allowance and an early indication of same is earnestly solicited.

Respectfully submitted,

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By 

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Atty. Dkt. No. 016891-0758

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Hirofumi KAMOSAWA, et al.

Title: LIQUID CRYSTAL DISPLAY
ELEMENT AND METHOD OF
MANUFACTURING

Appl. No.: 09/621,460

Filing Date: 7/21/00

Examiner: Prasad R. Akkapeddi

Art Unit: 2871

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MARKED-UP COPY OF AMENDMENT AND REQUEST FOR RECONSIDERATION
UNDER 37 C.F.R. § 1.116

Commissioner for Patents
Box AF
Washington, D.C. 20231

Sir:

In reply to the office action of April 24, 2002, please amend the above identified application as follows:

In the Written Description:

Please delete the paragraph beginning on page 1, line 17 and replace with the following:

Specifically, after affixing together an array substrate 10 and an opposing substrate 11, which are the pair of glass substrates, at least one of the array substrate 10 and the opposing substrate 11 is polished (steps 501 and 502). Next, after cutting the array substrate ~~10910~~ and the opposing substrate 11, a liquid crystal is injected between the array substrate 10 and the opposing substrate ~~11, this~~ 11. The resulting structure is sealed, and a polarizer is affixed thereto (steps 503 to 506).

Please delete the paragraph beginning on page 1, line 27 and replace with the

following:

For this reason, the polishing material ~~intrudes~~is intruded into the space (5 to 6 μ m) between the array substrate 10 and the opposing substrate 11, thereby causing failures due to this foreign matter, which lowers the display quality and yield of the liquid-crystal display elements.

Please delete the paragraph beginning on page 2, line 10 and replace with the following:

In this type of technology, because the overall liquid-crystal display element area is surrounded by an outer peripheral seal 18, in the above-noted case of performing polishing, intrusion of foreign matter into the space (5 to 6 μ m) between the array substrate 10 and the opposing substrate 11 is prevented.

Please delete the paragraph beginning on page 2, line 18 and replace with the following:

For this reason, because the stress on the pair of glass substrates is different between a part at which the outer peripheral seal 18 is cut and a part at which the outer peripheral seal 18 is not cut, ~~thereby causing improper cutting results~~ when scribing and breaking the substrates.

Please delete the paragraph beginning on page 2, line 25 and replace with the following:

If the manufacturing apparatus becomes contaminated in this manner, polishing material can intrude into the liquid-crystal display element when the liquid crystal is injected, leading to improper liquid crystal orientation and faulty operation, such as the proper voltage not being applied ~~between~~ across the liquid crystal, thereby causing a display failure and a drop in yield.

Please delete the paragraph beginning on page 3, line 9 and replace with the following:

Specifically, in a liquid-crystal display element according to one aspect of the

present invention, an array substrate on which a plurality of liquid-crystal injection areas are arranged and each liquid-crystal injection area is surrounded by a seal having an aperture and the ~~an~~ overall liquid-crystal injection areas being surrounded by an outer peripheral seal having an aperture, and an opposing substrate are adhered together, the aperture of the outer peripheral seal being sealed by a hole sealant, and a surface of at least one of the array substrate and the opposing substrate being polished with a polishing material, and thereafter, an end portion of at least either one of the array substrate and the opposing substrate being polished with end polishing operation so as to remove residual polishing material therefrom, after which cutting plurality of liquid-crystal injection areas along lines as formed between the opposite the aperture holes so as to separate individual liquid crystal injection areas.

Please delete the paragraph beginning on page 3, line 27 and replace with the following:

In this aspect of the present invention, it is possible to inject liquid crystal into each individual injection area, seal the areas, and adhere polarizers after the individual liquid crystal injection areas are separated.

Please delete the paragraph beginning on page 6, line 14 and replace with the following:

~~A spacer 14~~ Spacers 14 (only one of which is shown) ~~having spacers 14 disposed between the array substrate 10 and the opposing substrate 11~~ are disposed between the array substrate 10 and the opposing substrate 11 so as to maintain a uniform panel gap therebetween.

Please delete the paragraph beginning on page 7, line 4 and replace with the following:

Next, after hole sealing so that polishing material is not ~~intruded~~ introduced between the array substrate 10 and the opposing substrate 11, which are two glass substrates, the surface of at least one of the glass substrates is polished, and then the end surface is also polished, so as to make the thickness of the two glass substrates

small (steps 202 to 204).

Please delete the paragraph beginning on page 7, line 22 and replace with the following:

~~Adhering the~~The array substrate 10 and the opposing substrate 11, onto which is distributed the spacers 14, which maintain the panel gap uniformly, are adhered by heat treating ~~is done~~ at a temperature of 160°C, so as to harden the seal 12 and the outer peripheral seal 18.

Please delete the paragraph beginning on page 8, line 29 and replace with the following:

Also prevented are problems such as polishing material 21 being intruding between the glass substrates (Fig. 1) so as to cause poor orientation or prevent proper application of voltage across the liquid crystal 15.

Please delete the paragraph beginning on page 9, line 3 and replace with the following:

When the cutting apart is done, the hole sealant 20 on the line along the cutting line B-B' of Fig. 3 is traversed in making the cut. Because the hole sealant 20, in contrast to the epoxy resin used in the outer peripheral seal 18, is a soft acrylic resin, there is no particular stress applied to the glass substrates when the cutting is done, so that ~~there is prevention of bad~~undesirable scribing and breaking are prevented.

Please delete the paragraph beginning on page 9, line 9 and replace with the following:

In this embodiment of the present invention, therefore, each liquid-crystal injection area is surrounded by a seal 12, and the overall liquid-crystal injection area is surrounded by an array substrate 10 and an opposing substrate 11 surrounded by an outer peripheral seal 18 having apertures ~~19, the~~19. The apertures 19 of the outer peripheral seal 18 ~~being~~are sealed by a hole sealant 20, and the surface of at least on of the array substrate 10 and the opposing substrate 11 ~~being~~are polished with a

polishing material 21, which is then removed, after which cutting along the apertures is done to separate the individual liquid-crystal injection areas, ~~and in so doing to eliminate.~~ Using this method one eliminates residual polishing material 21 caused by bad cutting, thereby ~~enabling~~ facilitating the achievement of a thin liquid-crystal display element and improving the yield and the quality thereof.

Please delete the paragraph beginning on page 9, line 21 and replace with the following:

Although the above-noted embodiment of the present invention was described for the example in which the thicknesses of the array substrate 10 and opposing substrate 11, which are glass substrates, is made thin by polishing, it will be readily understood that the present invention is not restricted in this manner, and can be applied as well to a case in which, for example, the thickness of the array substrate 10 and the opposing substrate 11 is made thin by etching.

Please delete the paragraph beginning on page 10, line 6 and replace with the following:

In this embodiment, a liquid-crystal display element array is provided and as shown in Fig. 3, the liquid-crystal display element array of this embodiment comprises an array substrate 10 and an opposing substrate 11 and a plurality of liquid-crystal injection areas 30, each being surrounded by a seal 12 having an aperture 17 and the an overall liquid-crystal injection areas 30 being further surrounded by an outer peripheral seal 18 having apertures 19 sealed with a hole sealant 20, both of which being formed between the array substrate 10 and the opposing substrate 11, wherein at least a surface of either one of the array substrate and the opposing substrate ~~being~~is polished and at least an end portion of either one of the array substrate and the opposing substrate ~~being~~is polished, and further wherein a plurality of the apertures 19 ~~being~~are provided along each one of the outer peripheral seals 18-1 to 18-4 and at crossing points P each being formed between the outer peripheral seal 18 and a virtual line 40 along which the individual liquid-crystal injection areas 30 would thereafter be cut apart.

Please delete the paragraph beginning on page 10, line 21 and replace with the following:

In this embodiment, the end portion of ~~of either one of the array substrate and the opposing substrate showing~~has a tapered configuration.

In the Claims:

Please cancel claims 7-11.

1. (Amended) A liquid-crystal display element wherein an array substrate on which a plurality of liquid-crystal injection areas are arranged and each liquid-crystal injection area is surrounded by a seal having an aperture and said ~~an plurality overall of~~ liquid-crystal injection areas being surrounded by an outer peripheral seal having an ~~aperture~~at least one pair of oppositely disposed apertures, and an opposing substrate are adhered together, said ~~aperture~~at least one pair of oppositely disposed apertures of the outer peripheral seal being each sealed by a hole sealant, and a surface of at least one of said array substrate and said opposing substrate being polished with a polishing material, and thereafter, an end portion of at least either one of said array substrate and said opposing substrate being polished with an end polishing operation so as to remove residual polishing material therefrom, after which cutting said plurality of liquid-crystal injection areas along lines as formed between the ~~opposite said aperture holes at~~least one pair of oppositely disposed sealed apertures so as to separate individual liquid-crystal injection areas.

2. (Amended) A liquid-crystal display element according to claim 1, wherein a plurality of ~~said pairs of oppositely disposed~~ apertures of said outer peripheral seal are provided along said outer peripheral seal and at crossing points ~~each being~~ formed between said outer peripheral seal and a line along which said individual liquid-crystal injection areas are cut apart.

5. (Amended) A liquid-crystal display element array which comprises an array substrate and an opposing substrate and a plurality of liquid-crystal injection areas, each being surrounded by a seal having an aperture and said ~~an plurality overall of~~ liquid-crystal injection areas being further surrounded by an outer peripheral seal having

at least one pair of oppositely disposed apertures each sealed with a hole sealant, both of which being formed between said array substrate and said opposing substrate, wherein at least a surface of either one of said array substrate and said opposing substrate being polished and at least an end portion of either one of said array substrate and said opposing substrate being polished, and further wherein ~~a plurality of~~ said at least one pair of oppositely disposed apertures of said outer peripheral seal are being provided along ~~each one of~~ each one of said outer peripheral seals and at crossing points ~~each being~~ formed between said outer peripheral seal and a virtual line along which said individual liquid-crystal injection areas would thereafter be cut apart.

6. (Amended) A liquid-crystal display element array according to claim 5, wherein said end portion of ~~of at either~~ at least one of said array substrate and said opposing substrate ~~showing~~ has a tapered configuration.